URANIUM MINERAL FACT SHEETS

Introduction

Uranium (U) is a radioactive metal with a high specific gravity of 18.7. It was discovered in th Martin Klaproth in 1789 and was named after the planet Uranus.

Naturally occurring uranium consists of a mixture of three isotopes in the following proportion (0.71%) and U^{234} (0.01%). U^{235} has an outstanding property in that it is the only naturally-o By interaction with neutrons, the nucleus of U^{235} may be split into two parts. This splitting - t and more neutrons, starting a nuclear chain reaction. The large amounts of heat released by nuclear reactors to generate electricity.

Uranium has two main valencies - U^{4+} when it occurs in a reducing medium, and U^{6+} in an o Earth's surface. U^{6+} is more soluble than U^{4+} in natural waters. Streams carry a quantity of d on the geological characteristics of the region they drain. Sea water averages 0.003 parts per precipitates from groundwaters containing dissolved uranium when these waters enter a redu

In terms of abundance in the Earth's crust, uranium is about as common as tin, tungsten and

Occurence

More than 150 uranium-bearing minerals have been identified. The main primary minerals are (a mixed oxide, usually U_3O_8), brannerite (a complex oxide of uranium, rare-earths, iron and (uranium silicate). Most of the world's uranium is produced from pitchblende ores. The most i are carnotite, autunite, davidite, gummite, torbernite and uranophane.

Australia has some of the largest uranium deposits in the world and major uranium deposits c geological settings and rock types.

Australian Resources and Deposits

The earliest uranium deposits mined in Australia were at **Radium Hill** and Mount Painter (SA). from about 1910 to 1931 for radium, a radioactive daughter product of uranium, which was u purposes. Exploration for uranium in Australia began in 1944 at the request of the British Gov Government offered financial rewards and in 1949 the **Rum Jungle** deposit (NT) was discover **Kathleen** deposit (QLD) and a number of smaller deposits in the South Alligator Valley (NT) w and 1971 the following deposits were mined: **Rum Jungle** (1954 to 1971), **Radium Hill** (1954 to 1963) and South Alligator Valley (1959 to 1964).

Uranium exploration declined during the late 1950s but increased again in the late 1960s, stir government's export embargo and predictions of increased world demand for uranium in the electricity in nuclear power stations.

Important deposits were discovered between 1969 and 1973 at **Nabarlek**, **Ranger**, **Koongarra** Rivers area (NT), at **Beverley** and **Honeymoon** in the Lake Frome area (SA), at **Yeelirrie** and **L Dam** (SA) and **Kintyre** (WA) deposits were discovered in 1975 and 1985 respectively.

The **Mary Kathleen** mine recommenced production in 1975 and ceased operations in 1982. A produced from **Mary Kathleen** during its two periods as an operating mine. The **Nabarlek** depo in 1979. This stockpiled ore was processed from 1980 to mid-1988 for a total output of 10 85

Australia currently has three uranium mining operations - **Ranger, Olympic Dam**and **Beverley**

Ranger is a large unconformity-related deposit in the Alligator Rivers region (NT). The ore is r Production commenced in 1981 from the first ore body which has been mined out - mine proc ore body. The processing plant (acid leach and solvent extraction) has a production capacity Ranger mine area and the adjoining Jabiluka Mineral Lease are on Aboriginal land and they ar National Park.

Olympic Dam, is the world's largest uranium deposit (in terms of total reserves and resources occurs in a hematite-rich granite breccia complex and is beneath approximately 300 metres o of the Stuart Shelf geological province. The mine produces uranium, copper, gold and silver. underground methods (long-hole open stoping). Production began in 1988.

The operation has annual production capacity of 200 000 tonnes of refined copper, and 4300

Beverley in the Lake Frome area (SA), is the first in situ leach (ISL) uranium mine in Australia unconsolidated sands with inter-bedded clays (Upper Tertiary in age) that were deposited in a sequence. Mineralisation is at an average depth of 107 m below surface. Production commenc operation has capacity to produce 1000 tonnes U_3O_8 annually. Acid leach solutions and oxyge in situ, and resin-type ion-exchange techniques are used to recover uranium in the processing

Australia has the world's largest resources of low-cost uranium (recoverable at costs of less th approximately 43% of world resources in this category. Other countries which have large low- Kazakstan (21%), Canada (18%), South Africa (8%).

New Mine Developments

Jabiluka deposit, in the Alligator Rivers region, is approximately 20 km north of the **Ranger** mi are owned by **Energy Resources of Australia Ltd** (ERA). **Jabiluka** is one of the world's largest u with total resources containing 163 000 tonnes of U_3O_8.

The **Jabiluka** project was subjected to an exhaustive three-year environmental impact assessr separate assessments of both the options to mill **Jabiluka** ore at the existing **Ranger** facility ar on-site at **Jabiluka**>. Both options have received Australian Government environmental cleara complying with certain requirements.

The Traditional Aboriginal owners have not granted their approval to develop the deposit. The environmental care-and-maintenance phase. ERA and the Government have also given an un Heritage Committee that Ranger and Jabiluka will not be brought into full production simultan

Honeymoon deposit (south of Lake Frome) occurs in coarse-grained sands of Tertiary age and below surface. It has a roll-front shape and occurs at an oxidation-reduction interface along th

palaeochannel. Following an assessment of the Environmental Impact Statement in late 2000 cleared the way for the Honeymoon in situ leach operation to proceed. Planned production ra annually.

Mining

Uranium is usually mined by either open-cut methods (e.g. **Ranger**, **Nabarlek**, **Mary Kathleen** underground mining methods (e.g. **Olympic Dam**, **Radium Hill** and the South Alligator Valley d depth at which the orebody occurs. Sandstone-type deposits are usually mined by in situ leac solution is pumped through a permeable orebody to dissolve the uranium, which is then recov processing plant (e.g. **Beverley** and **Honeymoon** deposits).

Processing

Initially, the uranium ore is crushed and then ground to a fine grain size. Grinding and mixing of fine ore particles suspended in water. This slurry is leached with either an acid or an alkali, metallurgical characteristics of the ore. Leaching causes uranium to dissolve in the solution. M the ore remain undissolved, and these solids, called 'tailings', are then separated from the ura allowing them to settle out. The uranium-rich liquid is filtered to remove any remaining solids recovered by techniques using solvent extraction, ion exchange or direct precipitation. The m nature of the particular ore.

Uranium is finally recovered in a chemical precipitate that is filtered and dried to produce a ye 'yellowcake'. The yellowcake is heated to about 700° C to produce a dark grey-green uranium more than 98% U_3O_8, which is placed into 200 litre steel drums for export.

For ISL operations, uranium is recovered in a processing plant using either ion exchange or so

Uses

Uranium has two major peaceful uses: as the fuel in nuclear power reactors to generate elect of radioisotopes.

Electricity Generation.

In a nuclear reactor, the heat released during the fission of U^{235} is used to produce steam tha electricity. Approximately 16% of the world's electricity is currently generated by the use of u Some 439 nuclear power reactors with a total net capacity of over 350 gigawatts (electrical) a further 34 new reactors are under construction worldwide. A total of 16 countries generate m electricity requirements from nuclear reactors.

Exports of Australian Uranium

Australia has no significant national demand for uranium and all production is exported. Austr conditions to the export of uranium to ensure it is used only for peaceful purposes. These cor safeguards - require customer countries to allow international inspectors from the **Internation** verify that the uranium is not directed into weapons programs. In addition, Australia requires conditions under treaties it has concluded with end customer countries. This compliance is mo **Safeguards and Non-Proliferation Office**.

Suggestions for further reading

- McKay, A.D., & Miezitis, Y. (2001) Australia's uranium resources, geology and developr Geoscience Australia. Mineral Resource Report 1.
  Click here for report
- Uranium Information Centre web site www.uic.com.au